

Discovery of the Thoracic Feet in a Carboniferous Phyllocaridan. By A. S. Packard.

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It is a matter of some surprise that notwithstanding the large number of fossil Phyllocarida from the Palæozoic strata made known to us by the researches of McCoy, Salter, Barrande, H. Woodward, James Hall, J. M. Clark, R. P. Whitfield, C. E. Beecher and others, no definite, unmistakable traces of the limbs have been discovered. So far as we are aware, no portions of the antennæ of either pair, nor of the thoracic or abdominal limbs (except those next to the telson), have been figured or described, though many specimens of the fossils have been subjected to the scrutiny of our leading palæontologists. While most of the species are represented by the bivalvular carapace alone, which must have been, as in the recent *Nebalia*, easily detached after death from the body so as to float away by itself, still in some cases, as in that of *Ceratiocaris stygia* Salter, figured by Messrs. Jones and Woodward in the *Geological Magazine* for September, 1885, the abdominal segments, with the last pair of uropoda and the telson, are distinctly preserved, while in other cases the large toothed mandibles are preserved in place between the valves of the carapace; the rostrum has also sometimes been preserved. But we should have expected ere this to have become acquainted with the nature of the antennæ and the anterior abdominal appendages, if, as we have good reason to suppose, they were like those of the modern *Nebalia*.

In their diagnosis of the genus *Ceratiocaris*, Messrs. Jones and Woodward in referring to the body, state: "Body many jointed, with fourteen or more segments, of which 4-7 extend beyond the carapace; ornamented with delicate raised lines. Some or all of these segments bore small, lamelliform, branchial appendages."*

Although Messrs. Jones and Woodward have kindly sent me nearly all their valuable papers on fossil Crustacea, those cited in the foot-note, unfortunately are not among the number, and hence I am unable to refer to them. Mr. Etheridge's note in the *Annals and Magazine Natural History* is as follows:

"At the Brighton meeting of the British Association, Mr. H. Woodward, F.R.S., noticed the discovery of the 'swimming gills' of *Ceratiocaris*, to which I had previously drawn his attention. On a slab of thin flaggy shale from the Upper Silurian series of Lesmahagow are exposed, the caudal segments, telson, and caudal appendages of a *Ceratiocaris*. From the ventral margin of the terminal segment proceeds a broad paddle-shaped membranous (?) expansion, presenting a strong marginal outline,

* See the Sixth Report on Fossil Crustacea, Brit. Assoc. Report for 1872, p. 323, and *Geological Magazine*, ix, p. 561. Also a descriptive note by Mr. R. Etheridge, given in the *Mem. Geol. Surv. Scotl. Explan. Sheet 23*, 1873, p. 93, and *Annals and Mag. Nat. Hist. Ser. 4*, Vol. xiv, 1871, p. 9.

with a transversely striated surface. This is followed by another similar appendage, proceeding in the same manner from the penultimate segment. The dorsal edge of the specimen shows that one of the corresponding 'foot-gills' of the opposite side has been bent back upon itself, and thus thrust out of place. The free ends of these paddle-shaped appendages are attenuated to more or less rounded points. They do not show any evidence of a marginal fringe. These gill feet are no doubt analogous to the same supplementary abdominal organs in *Nebalia*."

I do not understand from the foregoing description, the nature of the so-called appendages, especially since they are not figured, but will now proceed to call attention to those noticed in a specimen sent me a year ago by J. C. Carr, Esq., of Morris, Illinois, which occurred in a nodule from the Carboniferous beds of Mazon creek at Morris.

As soon as I examined the fossil, the indications of broad lamellate appendages of several pairs were at once apparent. Owing to the incomplete state of preservation of the dorsal and ventral edges of the valves I was at a loss to what group to refer the fossil. It was apparently a Phyllocaridan, but seemed to differ from most of the genera described. I therefore considered it as the type of a new genus intermediate between *Ceratiocaris* and *Aristozoe*, and named it *Cryptozoe*; it may be called *Cryptozoe problematicus*. After, however, comparing the specimen with Dr. Woodward's figure of the Carboniferous *Ceratiocaris oretonensis* Woodw. and *C. truncatus* Woodw. (*Geological Magazine*, viii, March, 1871), and his figure of *C. papilio* Salter and *C. stygia* Salter (*Geological Magazine*, September, 1885), I was inclined to provisionally regard it as belonging to that genus.

But on consulting my friend, Mr. C. E. Beecher, who has worked so faithfully on the fossil Phyllocarida, he kindly sent me the following opinion :

ALBANY, Dec. 30, 1885.

The typical *Ceratiocaris* (see McCoy's description) differs from your specimen in its semi-elliptical outline, with the abruptly truncated posterior end and evenly convex valves.

Your species has a short hinge-line, very broadly rounded posterior end, and the cephalic and thoracic regions of the carapace are well defined. These are characters which do not belong to *Ceratiocaris* when strictly defined. The contour of the dorso-anterior extremity would seem to indicate the presence of a well-developed rostrum. The typical *Ceratiocaris* are from the Silurian system, and I very much doubt their extension into the Carboniferous, although they have been noted in the Devonian. I have not seen the article by Woodward and Jones which you mention.

I should be inclined to consider this as a type of a new genus.

It is very interesting, especially as furnishing some information as to the appendages.

CHAS. E. BEECHER.

The generic characters as drawn from the carapace alone are as follows : Valves one half as long as broad ; moderately full and convex, with no definite, straight hinge-margin. It differs from *Ceratiocaris* in the lack of a long, straight hinge-margin, the dorsal edge being curved, and in the lower edge not being thickened, while the posterior end is well rounded. The anterior end of the valves is about half as wide as the posterior end, and is oblique, the lower part of the edge being directed outwards. From *Aristozoe* it differs in the lack of a definite hinge-margin, and in its elongated oval valves ; from *Nothozoe* in its well defined narrow anterior end, and well defined dorsal and ventral edges.

As Mr. Scudder's genus *Rhachura** from the Carboniferous limestone of Danville, Illinois, is only represented by the end of the abdomen, it is impossible to discuss its relationship to that form.

The specimen is a cast, and shows no tracings of markings on the exterior of the valves. In form it is ovate, obliquely truncated at each end ; the dorsal edge is not so much curved as the ventral edge, but it is more curved towards the posterior edge than towards the anterior ; the ventral edge is quite regularly curved. The anterior end is obliquely truncated, the lower angle directed outwards. The posterior edge is about a third wider than the anterior end, and is directed obliquely inwards so as to be nearly parallel with the anterior end. While each end of the valves is well preserved, the dorsal and ventral edges have apparently not been preserved, as they are usually thickened in the other species of the genus.

The lamellate limbs are situated in the specimen at the posterior end of the carapace ; probably after death the carapace turned around and separated from the body, which with the extremities became much displaced.

Of the lamellate limbs there are traces of four pairs. They are broad and thin, slightly contracted in width near the base, and at the distal extremity quite regularly rounded, with the free ends apparently slightly folded longitudinally, the edges appearing to be slightly crenulated, but



FIG. 3.—Outline of *Cryptozoe problematicus*, showing the shape of the lamellate feet, the valve being upside down.

these folds were perhaps due to changes after death. All the feet are of nearly the same size. They are about two thirds as long as the carapace

* Proc. Bost. Soc. Nat. Hist. xlix, 1878, Pl. 8, Fig. 3, 3a.

